Manuals

Operator Manual

Welch Allyn

Service Manual

Spot Vital Signs

PN 95P506E
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Spot Vital Signs Service Manual

Revision History

Version	Date	Author	Description
A	3/31/01	JDB	Introduction of Service Manual

Table of Contents

Section 1 General Information 5
1.1-To Service Personnel: 5
1.2 Limited Warranty 6
Service Policy 6
Technical Assistance 6
1.3 Basic System Description 8
Introduction 8
1.4 Basic System Operation 9
1.5 Specifications 13
1.6 Identification Label and Serial Numbering System Defined 16
1.7 Firmware Identification 17
Section 2 Service 18
2.1 Intent of Manual and Product Scope. 18
2.2 Test Equipment Bench Layout: 19
2.3 Required Tools and Fixtures for Service 20
2.4 Required Tools and Fixtures for Service 21
2.5-Replacement Parts : 22
2.6-Supplies and Accessories: 22
2.7 Maintenance and Service Support 25
Section 3 Problem Diagnosis 26
3.1 Diagnostic Procedure for Returned Units 26
3.2 Calibration Procedure : Voltage 29
3.3 Calibration Procedure : Pressure 30
3.4 SELF DIAGNOSTIC FAULT CODES 31
3.5 COMPLAINT / CAUSE / CORRECTIVE ACTION 33
Section 4 Removal/Replacement of Parts 39
4.1 Battery 39
4.2 Temperature Pod and Temperature Connector PCB removal 40
4.3 Front Housing and Switch Array 41
4.4 Display PCB 42
4.5 Remove Power and Battery Cable 43
4.6 Main PCB Removal 44
4.7 SpO2 PCB Removal (If configured with SpO2) 45
4.8 Pump and Valve Removal 46
Section 5 Test Procedures 47
Section 5.1 Calibration Tests 47
Section 5.2 Current Tests 48
Section 5.3 Noise Levels 49
Section 5.4 Button Test 50
Section 5.5 Interface Test 51
Section 5.6 Print Quality 52
Section 5.7 Pneumatic Tests 53
Section 5.8 SpO2 Tests 54
Section 5.9 Temperature Tests 55
Section 5.10 Fail Safe Testing 56
Section 5.11 Check List For Spot Vital Signs Service Work 57
Section 6 Drawings 59
Section 7 Repair Test Specifications 60

Section 1 General Information

1.1-To Service Personnel:

Read and understand the Spot Vital Signs Operator's Manual and this Service Manual. The information contained in both of these publications is subject to change without notice and should not be construed as a commitment by Welch Allyn, Inc.

Welch Allyn assumes no responsibility for any errors that may appear in this manual. If the product and/or its operation varies significantly from any description herein, please contact the following:

WELCH ALLYN,, INC. TECHNICAL SERVICE DEPARTMENT:
1-800-450-9275
(828) 684-4895
Fax (828)687-1002

Welch Allyn,, Inc. .
95 Old Shoals Road
Arden, North Carolina 28704

This product has been designed to provide a high degree of safety and reliability. However, we can not guarantee against: deterioration of components due to aging, normal wear, tampering, and abuse.

All service and repairs must be performed by authorized Welch Allyn personnel or agents, using approved Welch Allyn replacement parts and approved process materials. Failure to so will invalidate the product warranty. Please refer to the product warranty for specific coverage.

Welch Allyn, Inc.
95 Old Shoals Road
Arden, North Carolina 28704
USA
1 800 450-9275

1.2 Limited Warranty

Welch Allyn, Inc. warrants the Spot Vital Signs, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of two years from the date of purchase from Welch Allyn, Inc. or its authorized distributors or agents. Welch Allyn, Inc. will either repair or replace any components found to be defective or at variance from manufacturer's specifications within this time at no cost to the customer. It shall be the purchaser's responsibility to return the instrument to Welch Allyn, Inc. or an authorized distributor, agent or service representative. This warranty does not include breakage or failure due to tampering, misuse, neglect, accidents, modification or shipping. This warranty is also void if the instrument is not used in accordance with manufacturer's recommendations or if repaired by other than Welch Allyn, Inc. or an authorized agent. Purchase date determines warranty requirements. No other express warranty is given.

To receive service assistance or to ask questions regarding this warranty, please call or write:
Welch Allyn, Inc. Technical Services Dept.
95 Old Shoals Road
Arden, North Carolina 28704 USA
1 (800) 450-9275 or (828) 684-4895
Fax: (828) 687-1002

Service Policy

All repairs on products under warranty must be performed or approved by a Welch Allyn, Inc. Service Center. *Unauthorized repairs will void the warranty*. Products out of warranty should be repaired by qualified electronics personnel or a Welch Allyn, Inc. Service Center.

Technical Assistance

If you have an equipment problem that you cannot resolve, call the Welch Allyn, Inc. Service Center nearest you for assistance. Technical service support is available to you by telephone on normal business days at the locations listed on the next page

Before returning a product for repair you must obtain authorization from Welch Allyn, Inc. An RMA (Return Material Authorization) number will be given to you by our service personnel. Be sure to note this number on the outside of your shipping box. Returns without an RMA number will not be accepted for delivery.

Welch Allyn, Inc. Service Centers

For Service or Repair

USA Customers

Welch Allyn, Inc.
Technical Service Centers
95 Old Shoals Road
Arden, NC 28704-9739 USA
Phone: 828-684-4895
Fax: 828-687-1002

CANADA Customers

Welch Allyn Canada Limited
Technical Service Centers
160 Matheson Blvd., East
Mississauga, Ontario L4Z CANADA
Phone: 905-890-0004 or 1 800-561-8797
Fax: 905-890-0008

INTERNATIONAL Customers

Welch Allyn GmbH
Technical Service Center
Zollerstrasse 2-4 Road
D-72417 Jungingen
GERMANY
Phone: [49]-7477-927-10
Fax: [49]-7477-9271-90

Welch Allyn Australia Pty. Ltd.
Technical Service Center
5/38-46 South Street
Rydalmere NSW 1701
AUSTRALIA
Phone: [61] 29-4183-155
Fax: [61] 29-4183 650

Welch Allyn Ltd.
21-09 Golden Mile to 6001
Beach Road
Singapore 199589
REPUBLIC OF SINGAPORE
Phone: [65]-291-0882
Fax: [65]-291-5780

Welch Allyn UK Ltd.
Cublington Road
Aston Abbots
Buckinghamshire HP22 4ND
UNITED KINGDOM
Phone: [44] 129-668-2140
Fax: [44] 129-668-2104

LATIN AMERICA Customers

MDI International
Technical Service Centers
7324 SW 48th Street
Suite A
Miami, FL 33155 USA
Phone: (305)-669-9591
Fax: (305)-669-1971

1.3 Basic System Description

Introduction

The Welch Allyn Spot Vital Signs is designed to non-invasively and automatically measure systolic and diastolic pressure, pulse rate, temperature and oxygen saturation (SpO2) for adult and pediatric patients. THE WELCH ALLYN SPOT VITAL SIGNS IS NOT INTENDED TO BE USED ON NEONATAL PATIENTS. All blood pressure, pulse, temperature and SpO2 values can be viewed on a large, easy-to-read display, and may be printed via the IrDA port to an external printer as desired. The rechargeable lead acid battery and variety of mounting accessories make the Welch Allyn Spot Vital Signs convenient for many locations. The operator may choose any combination of simultaneous measurement modalities. The Welch Allyn Spot Vital Signs is intended for use in a wide variety of health care settings. This includes hospital departments, as well as alternate care settings, such as physicians offices, clinics, and long term care facilities. The Welch Allyn Spot Vital Signs is not intended for continuous monitoring of patients, or for use during transport of a patient. The Welch Allyn Spot Vital Signs is not intended for use in environments that are not supervised by a health care practitioner.

Refer to the Spot Vital Signs Operator's Manual for complete information on Indications For Use, Special Features, Supplies and Accessories

1.4 Basic System Operation

Blood Pressure Measurements

A single blood pressure determination is made when the blood pressure START/STOP button is pushed.

A measurement cycle may be cancelled at any time by pressing the BP START/STOP button again. This action immediately initiates a rapid cuff deflation.

The blood pressure measurement data will appear on the display immediately following the measurement and remain displayed for two minutes. After two minutes, the display goes blank, and the device will go into standby mode. The most recent BP measurement may be recalled by pressing the Print, Mode, Next Patient/Clear or BP Start/Stop button.

Max/Min Blood Pressure Ranges

The maximum and minimum ranges of blood pressure are detailed below:

Measurement	Maximum	Minimum
Systolic Pressure	250 mmHg	60 mmHg
Diastolic Pressure	160mmHg	30 mmHg

Mean Arterial Pressure (MAP)

Ranges 40 - 190mmHg

Calculated from Systolic and Diastolic data (not directly measured).

Temperature Operating Modes

Thermometry measurements are made with the Welch Allyn SureTemp ™ technology. Oral and rectal probes utilize single-use disposable probe covers that limit cross-contamination. Oral, axillary or rectal temperatures are taken using ‘Normal or ‘Monitor operating modes. Axillary temperatures are taken using the (blue) oral probe.

Rectal temperatures are taken using the (red) rectal probe. In the Normal mode the thermometer's microprocessor "predicts" body temperature in about 4 seconds for oral temperatures, about 10 seconds for axillary temperatures, and in about 15 seconds for rectal temperatures. The monitor mode displays the patient's actual temperature after 3 minutes for oral/ rectal mode and 5 minutes for axillary mode, and will continue to display an updated temperature as long as the probe remains in place. Temperature readings may be displayed in Fahrenheit or Celsius scales.

Max/Min Temperature Ranges

Measurement	Maximum	Minimum
Temperature	109.4°F 43.0°C	86.0°F 30.0°C

Temperature Normal Mode

In Normal Mode, the Spot Vital Signs will measure temperature at discrete intervals and then calculate the rate of change according to a proven algorithm. This allows the thermometer to predict the end point that the thermistor would reach if it were left in the mouth until it reached mouth temperature. This predictive feature allows the thermometer to arrive at an accurate oral temperature reading in approximately 4 seconds.

Normal mode is the default operating mode for the temperature determinations.

Operator selectable patient alarm limits are not available in temperature Normal mode. However, temperatures that are outside of the operating range of the device will be noted on the temperature display.

Temperature Monitor Mode

Continuous Monitor Mode operation is normally used when difficult situations prevent accurate temperatures from being taken in the Normal mode. The probe must be in contact with tissue for at least three minutes for accurate oral/rectal temperature measurement and five minutes for accurate axillary temperature measurement. Monitor mode temperatures may not be identical to predicted 'Normal' temperatures because of ambient temperature influence and other factors The trend in temperature is the important standard to be observed when in the Monitor mode. Operator selectable patient alarm limits are not available in temperature monitor mode. However, temperatures that are outside of the normal operating range of the device will be noted on the temperature display.

SpO2 Operating Mode

* The Spot Vital Signs incorporates the Nellcor Puritan Bennett ™ pulse oximetry system which determines arterial oxyhemoglobin saturation (SpO2 %) by measuring the absorption of red and infrared light passed through the tissues.

* Changes in absorption caused by pulsation of blood in the vascular bed are used to determine arterial saturation and pulse rate. Oxygen saturation percent is calculated with each pulse detected, and thus the device display is continually updated. The pulse signal bar graph is an indicator of the strength and quality of the detected pulses.
* The Spot Vital Signs is capable of determining pulse rate as an adjunct to the blood pressure measurement and the SpO2 measurement.
* The pulse rate, in beats per minute, will be determined primarily from the SpO2 measurement methodology. In the case where SpO2 is not available, or is disabled, the pulse rate display will be driven from data collected as part of the blood pressure measurement method.
* Removal of the SpO2 sensor from the patient will initiate an audible beep, to alert the user that the sensor has been disconnected.
* SpO2 is generally measured via pulses detected using a finger sensor, and performs most accurately with the finger clip sensor. The finger clip sensor may be used on all fingers except the thumb. For certain situations SpO2 may be measured at alternate sites including the earlobe, forehead and toes. Special sensors must be employed in these situations. The finger clip sensor is recommended for spot checks or short-term evaluation (less than 60 minutes). Patient supervision is required as the Spot Vital Signs has no alarm capability.
* Oxygen Saturation and pulse rate is displayed on the LCD display. On each detected pulse, the pulse signal bar graph flashes. The intensity of this signal is a simple visual indicator of waveform signal strength, and can identify situations where the pulsatile nature of the tissue may not be adequate for an accurate SpO2 reading. The update interval bar of the bar graph should correspond to the patient's pulse rate. This is an indication of the quality of the SpO2 signal.

Max/min SpO2 Ranges
The SpO2 sensor is designed to detect oxygen saturation as follows:

	Maximum	Minimum
SpO_2	100%	40%

Pulse Rate Feature

The Welch Allyn Spot Vital Signs is capable of determining pulse rate as an adjunct to the blood pressure measurement and the SpO2 measurement. The pulse rate, in beats per minute, will be determined primarily from the SpO2 measurement methodology. In the case where SpO2 is not available, or is disabled, the pulse rate display will be derived by data from the blood pressure measurement method.

Max/Min Pulse Rate Ranges

The maximum and minimum pulse rate ranges are as follows:

Maximum	Minimum	
200 bpm	40 bpm	Using B.P. determination
245 bpm	25 bpm	Using SpO_2 determination

1.5 Specifications

The performance specifications of the Spot Vital Signs are as follows:

Patient Population
The Welch Allyn Spot Vital Signs is designed for use with adult and pediatric patients. Welch Allyn defines a pediatric patient as 29 days old and above. THE SPOT VITAL SIGNS IS NOT INTENDED FOR USE WITH NEONATES. Welch Allyn defines neonates as children 28 days or less of age born at term (37 weeks gestation or more): otherwise, up to 44 gestational weeks.

Cuff Pressure Range
0 mmHg - 300mmHg

Initial Cuff Inflation
160 mmHg, smart inflation

Systolic Determination
Maximum: 250 mmHg
Minimum: 60 mmHg

Diastolic Determination
Maximum: 160 mmHg
Minimum: 30 mmHg

Blood Pressure Accuracy
Blood pressure accuracy meets or exceeds SP10-1992 AAMI standards for non-invasive blood pressure accuracy (AAMI standard: ± 5 mmHg mean error; 8 mmHg standard deviation). Blood pressure accuracy is validated for pressure measurement using the upper arm only.

Blood Pressure Determination Time
20 seconds to 45 seconds typical, 165 seconds maximum.

Pulse Rate Determination (Using SpO2 determination)
Maximum: 245bpm
Minimum: 25bpm

Pulse Rate Accuracy
SpO2 Module Heart Rate ±3.0 bpm
Blood Pressure Algorithm Heart Rate ±5.0

Overpressure Cutoff
315 mmHg ±15 mmHg

Temperature Ranges

Measurement	Maximum	Minimum
Temperature	Max 109.4°F Max 43.0°C	Min 86.0°F Min 30.0°C

Temperature Accuracy
Temperature accuracy meets or exceeds ASTM E112-86: "Standard Specification for Electronic Thermometer for Intermittent Determination of Patient Temperature."

Temperature Determination Time
(Oral) 4 seconds typical, 15 seconds maximum
(Axillary) 10 seconds typical
(Rectal) 15 seconds typical

Oxygen Saturation Range (SpO2 %)
40-100% oxygen saturation

SpO2 Accuracy
±3% in the range of 70-100% oxygen saturation (1 Standard Deviation)
<70% unspecified by the OEM.

Battery Charging
To 90%-100% capacity in 12 hours. Unit will operate and charge battery simultaneously when connected to power source.

Mechanical Specifications

Dimensions
Height 9.70 inches (24.64 cm)
Length 5.72 inches (14.53 cm)
Depth 4.73 inches (12.01 cm)

Weight
Approximately 4.25 pounds

Mounting
Self-supporting on rubber feet
Custom Mobile Stand
Custom Made Wall Mount

Portability
May be hand carried when held by the rear handle.

Electrical Specifications

Power Requirements
Patient-Rated isolation transformer is connected to AC mains:
North American Version: 120VAC, 60 Hz. 0.20A Input Source, 8VDC, 0.75A Output Source
International Version: 220-240VAC, 50-60Hz 0.20A Input Source, 8VDC, 0.75A Output Source
Battery
Lead acid, with external charger.
A fully charged battery will support **150**"typical" blood pressure determinations taken at 7 minute intervals. Battery is 90-100% charged after 6-12 hours of charging. The battery automatically charges when the Spot Vital Signs is powered through the AC power transformer. The battery will charge faster when the instrument is not in operation.

Environmental Specifications

Operating Temperature
+10°C to +40°C (Except temperature 16°C to 40° C)
+50°F to +104°F

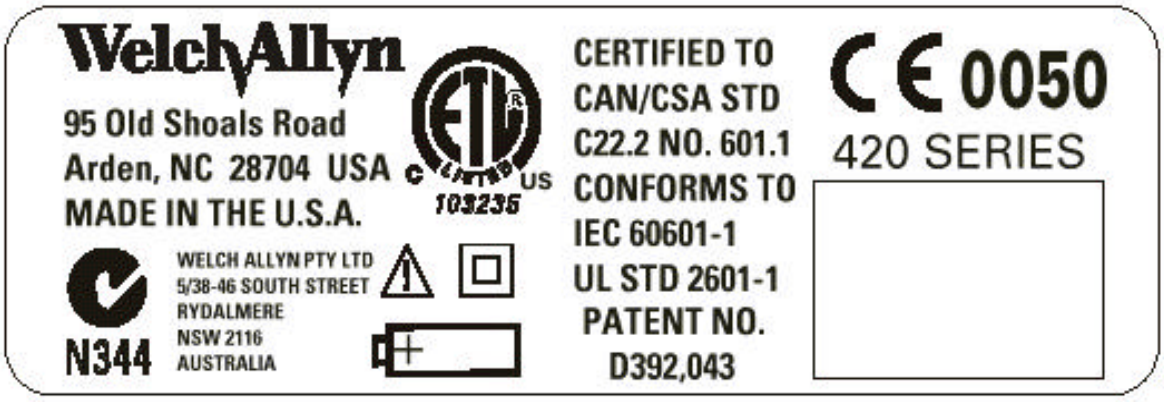
Storage Temperature
-20°C to +50°C
-4°F to +122°F

Relative Humidity
15 to 90% (non-condensing)

Operating Altitude
-170m to +4877m
-557ft. to +16,000ft.

1.6 Identification Label and Serial Numbering System Defined

The identification label for the 420 Series Spot Vital Signs is shown below. It is located on the bottom of the unit.



The serial number for the device would consist of nine (9) numbers and a bar code. These would be located in the square below the words “420 Series.” An example of the number and the explanation is shown below:

200100001

The four digits on the left Are the year of manufacture of the device.
The five digits on the right are the sequence of build starting with 00001 annually.

(The example number above would be the first unit built in 2001)

1.7 Firmware Identification

To confirm the software levels of the 420 Series Spot Vital Signs, place the unit into the "Configuration Test" mode by holding down the ***Start*** button while the unit is being powered up.

The main software versions will appear as follows:
* In the SW1 Screen, the top two numbers is the software version of the Spot Module and the other numbers are for the SpO2 module (if installed). Press the "Start" or "Clear" button to cycle through the SpO2 software number.

In the SW2 screen, The two numbers represent the NIBP module software and the Temperature Algorithm Version (If temperature is active.).

Note: *Verify the firmware levels by reviewing the Repair Test Specifications document.*

Section 2 Service

2.1 Intent of Manual and Product Scope.

This manual provides technical service and re-calibration information to technicians authorized to repair and recalibrate Welch Allyn, Inc. products. When used in conjunction with the required test equipment and tools, technicians will be able to diagnose, repair, and recalibrate, and test the Spot Vital Signs.

The manual includes: Re-calibration instructions, fault/cause analysis, step by step disassembly and re-assembly procedures, repair, adjustment, and re-test procedures.

2.2 Test Equipment Bench Layout:

Figure 2.2 depicts recommended layout of test equipment and special tools for service and re-calibration of the Spot Vital Signs.

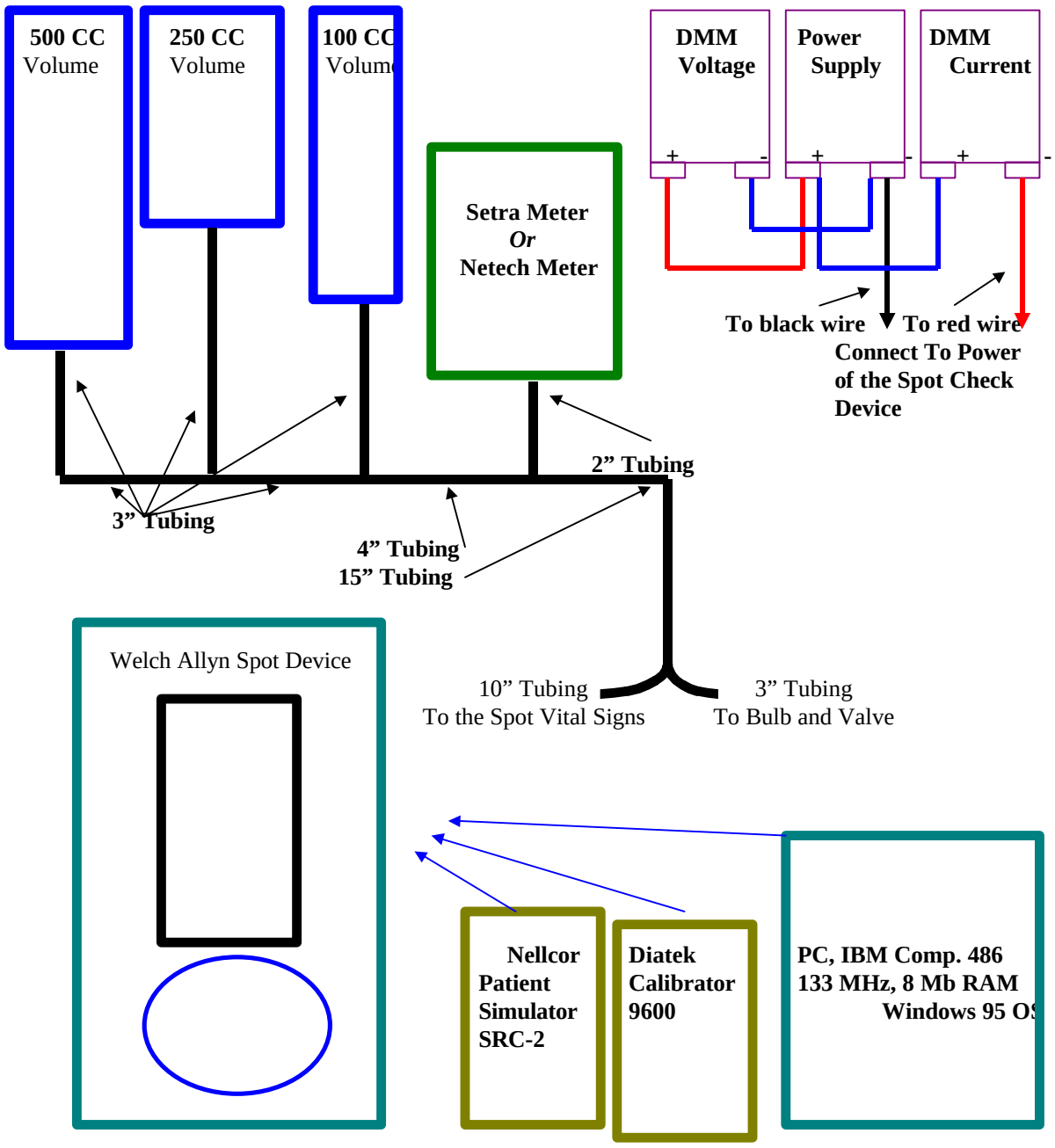


FIGURE 2.2

BENCH LAYOUT FOR RE-CALIBRATING AND TESTING SPOT VITAL SIGNS

2.3 Required Tools and Fixtures for Service

Special tools below can be ordered from Welch Allyn, Inc.

DESCRIPTION	**TOOL #**
100cc TEST VOLUME	T112819
250cc TEST VOLUME	T112818
500cc TEST VOLUME	T112854
DIGITAL TIMER	8456T12
PLIERS	T112458
BULB AND VALVE	5088-01
WIRE CUTTERS	T112486
TWEEZERS	T112511
PNEUMATIC TUBING (3 ea.)	5089-12
"Y" FITTING	9586TPK4
"T" FITTING (3)	9585TPK4
TEST CABLE (IR)	66P824
TEST CABLE (Service Cable Kit)	66S553
PNEUMATIC CLAMPS (3)	21730-001
TORQUE SCREWDRIVER	T112917
TORQUE SCREWDRIVER	T112918
TORQUE DRIVER	T112918A
CUSTOM REPAIR SOFTWARE	130S57
#4 PHILLIPS BIT	T112919
T10 TORX BIT	T114030
3/8 HEX SOCKET	T114135
CABLE TIE TOOL	T112845
DIATEK 9600 CALIBRATOR	01800-210
DIATEK CAL. KEY	06137-000
NELLCOR PATIENT SIMULATOR	SRC-2
NELLCOR TEST CABLE	EC-8
SERVICE MANUAL	4200-145E
DIGITAL PRESSURE METERS	
SETRA METER (0-10 PSIG)	***2270-01***
NETECH METER	***200-2000IN***
Notes: The entire set of equipment listed above can be ordered through Welch Allyn by the following number: ***Eleckit***	
A *Setra Meter (2270-01)* or a *Netech Meter (200-2000 IN)* must to be ordered along with the ***Eleckit.***	
Individual equipment numbers can be ordered by themselves.	
NO DISCOUNTS	

2.4 Required Tools and Fixtures for Service

The following equipment is need for service/repair and can not be obtained from Welch Allyn, Inc.

- IBM compatible 486 133 MHz computer or better. The computer must have Windows 95 with a serial port. CPU must have 8 Megabytes of RAM.

- 2 Digital Multi-Meters. These meters must have 4 1/2 digit displays for accuracy.

- Power Supply. 0-20 Vdc adjustable with 0-3A output.

- Oscilloscope. 60 MHz minimum.

2.5-Replacement Parts :

Drawing Number Reference*	Part #	Description
1	421100-502	Main PCB
2	421030	Flex Cable; Main to Display
3	421023-501	Pump Sub-assembly
4	421045	IR Window
5	421020-501	Display Module
6	421002-501	Battery Assembly
7	421029	Cable Assembly (Power)
8	421040	Rear Housing
9	421049-502	Front Housing Assembly
10	421044	Temperature Pod Housing
11	421048	SpO2 Cover
12	421042	Battery Cover
13	421047	SpO2 Latch
14	421009	Key Pad
15	421105-501	Temperature Assembly PCB
16	125S222	Nellcor SpO2 PCB
17	421099	Cable Assembly (pump/valve - Pneutronics Valve)
18	121S106	Pneutronics Valve
19	421066	Flex Cable, Temperature to Main PCB
20	421001-502	Pneumatic Assembly

** - Numbers corresponding to the parts shown in the exploded view drawing in section 6.*

2.6-Supplies and Accessories:

The following parts can be purchased by the end user as well as the authorized repair sites.

Blood Pressure Accessories And Supplies- Latex Free

Cuff and Bag Combination

5200-01 Adult (cuff, bladder and connector)
5200-02 Large Adult (cuff, bladder and connector)
5200-03 Small (cuff, bladder and connector)
5200-10 Thigh (cuff, bladder and connector)

Durable One-Piece Cuff

5200-13 Small Child (one-piece cuff and connector)
5200-14 Child (one piece cuff and connector)

5200-15 Small Adult (one piece cuff and connector)
5200-16 Adult (one piece cuff and connector
5200-17 Lg. Adult (one piece cuff and connector)
5200-18 Extra Large Adult (one piece cuff and connector)

Disposable Monitor Style One-Piece Blood Pressure Cuff

5082-93-3 Small Child Cuff
5082-94-3 Child Cuff (white)
5082-94P-3 Child Cuff (print)
5082-95-3 Small Adult Cuff
5082-96-3 Adult Cuff
5082-97-3 Large Adult Cuff
5082-98-3 Thigh Cuff

Miscellaneous

5082-59 Cuff: Adult
5082-61 Cuff: Large Adult
5082-63 Cuff: Child Print
5082-64 Cuff: Thigh
5200-04 Bladder: Adult (includes connector)
5200-05 Bladder: Large Adult (includes connector)
5200-06 Bladder: Child (includes connector)
5200-11 Bladder: Thigh (includes connector)
5200-07 Coiled Pressure Hose (8ft.) (2.4M) *Note: One additional hose may be connected to provide extended length. All appropriate connectors are included.*
5200-12 Straight Pressure Hose (8ft.) (2.4M)
5200-08 Calibration T-Connector

Temperature Accessories And Supplies

02678-100 Oral Probe: (9ft.) (2.7M)
02679-100 Rectal Probe: (9ft.) (2.7M)
05031-101 Disposable Probe Covers (1000 covers, packaged 25/box)
06137-000 Temperature Calibration key
01800-210 Model 9600 Temperature Calibration Kit, 110v

Nellcor Puritan Bennett ™ Pulse Oximetry Accessories And Supplies

DS-100A DURASENSOR ® Adult Oxygen Transducer
EC-8 Extension Cable (8ft.)
D-YS DURA-Y ® Oxygen Transducer (1 sensor, 40 wraps)
D-YSE Ear Clip, (use with Dura-Y sensor)
D-YSPD PediCheck ™ Pediatric Spot Check (use with Dura-Y sensor)
D-25 OXISENSOR ® II Adult Digit Oxygen Transducer (case of 24)
D-25L OXISENSOR ® II Adult Digit Oxygen Transducer, long cable (case of 24)

D-20 OXISENSOR ® II Pediatric Oxygen Transducer (case of 24)
I-20 OXISENSOR ® II Infant Digit Oxygen Transducer (case of 24)
R-15 OXISENSOR ® II Adult Nasal Oxygen Transducer (case of 24)
OXICLIQ ® A Adult Oxygen Transducer, use with OC-3 cable (case of 24)
OXICLIQ ® P Pediatric Oxygen Transducer, use with OC-3 cable (case of 24)
OC-3 OXICLIQ ® Sensor Cable
OXI-A/N OXIBAND ® Adult/ Neonatal Oxygen Transducer (1 sensor, 50 wraps)
OXI-P/I OXIBAND ® Pediatric/ Infant Oxygen Transducer (1 sensor, 50 wraps)
RS-10 Reflectance Oxygen Transducer (6 sensors, 6 headbands)
SRC-2 Portable Oximetry Tester

Mounting Accessories And Supplies

4200-60 Complete Mobile Stand Unit
includes: Storage Basket Pole and Base Assembly Transformer Mounting Kit
4200-62 Complete Wall Mount Unit
includes: Storage Basket Wall Mount Bracket Transformer Mounting Kit Recommended.
4200-64 Complete IV Pole Mount Unit
includes: Storage Basket, IV Pole Mount Bracket, Transformer Mounting Bracket.
4200-70 Anti-Theft Kit for Mounting Device

Miscellaneous Supplies

14042 Thermal Printer
14052 Thermal Printer with Mobile Stand Mount
53600 Printer Paper (1 case, 6 boxes, 24 rolls)
53600B Printer Paper (4 roll box)
4200-84 Lead Acid Battery
4200-85E Operator Manual
421054-1E Quick Reference Card
4200-145E Service Manual
4200-100 Welch Allyn Spot Vital Signs Carrying Case
5200-101A AC Power Transformer *(desktop transformer, line cord not included) -North American Version*
5200-102A AC Power Transformer *(desktop transformer, line cord not included) -European Version*
5200-103A AC Power Transformer *(desktop transformer, line cord not included) -United Kingdom Version*
4200-110 Line Cord (United States/Canada/Japan version)
4200-111 Line Cord (European version)
4200-112 Line Cord (United Kingdom version)
4200-113 Line Cord (Australian version)

2.7 Maintenance and Service Support

Owner Maintenance: Non-Technical customers can perform normal maintenance per the instructions provided in the Operator's Manual. End users will be able to perform basic operations such as replacement of: hoses, cuffs, probes, and batteries. On this level the unit will not be opened (except for the battery housing). Opening of the Spot Vital Signs by untrained individuals will damage the unit and void the warranty.

Technical Service/Repair/Re-calibration: Properly trained and equipped bio-medical departments and service centers will be able to utilize the content of this Service Manual. Technical skills in electronics and PC skills are required. These departments and centers must have service manual and re-calibration software, repair tools and test equipment as listed in this manual.

Note: Welch Allyn, Inc. recommends that the calibration of the Spot Vital Signs be checked on a yearly basis for BP, Temperature and SpO2 (if applicable).

Section 3 Problem Diagnosis

3.1 Diagnostic Procedure for Returned Units

NOTES:
A. The word "unit" in this text refers to the Spot Vital Signs.
B. "Menu|Choice" represents menu commands. Rather than use the phrase "choose the exit command from the File menu."

1. Remove the battery from the unit. Connect the unit to the power supply. Set the power supply to 6.5 Vdc +/- 0.2 Vdc.

2. With a digital multi-meter, check the voltage of the battery. If the voltage of the battery is less than 6.0 Vdc, the battery needs to be charged. Up on completion of this procedure, place the battery back into the unit and plug up the charger. Let the battery charge for 8 hours. Next allow the unit to set for 1 day and recheck the battery voltage. If the voltage is below 6.0 Vdc, change the battery.
(Reference section 4.1 page 39)

3. Power up the unit. If the unit does not power up:
   A. Insure the power supply is on and has the correct requirements as called out for in the repair manual.
   B. The power supply is connected to the unit and turned on.
   C. Check that the fuse is not blown. **(Reference section 4.6 page 44)**
   D. Change the main PCB. **(Reference section 4.6 page 44)**
   E. Change the display PCB. **(Reference section 4.4 page 42)**

If the unit does power up:
4.To check the display PCB, observe the unit during power up. All of the LCD segments should be lit for 1-2 seconds before the unit gets to its normal mode. If the unit has any LCD segments out change the display PCB. **(Reference section 4.4 page 42)**

5. Run a couple of blood pressure cycles to insure proper inflation/deflation and readings.

6. If the unit is not inflating/deflating properly:
   A. Open up the unit by removing the 4 housing screws.
   B. Check the unit for pinched tubing if the unit is deflating too slow. With the housing opened, re-run the blood pressure cycle to see if the deflating problem has been fix. Re-route tubing if pinch is found.
   C. If there are no pinched tubes, change the valve. **(Reference section 4.8 page 46)**
   D. Power down the unit. Place unit into configuration test mode by holding down the "start" button as power is re-applied. Press the mode button until "cal" appears in at the top of the LCD window.

Press the “start” button to close the valve. Pump up the unit using the bulb and valve inflate the unit to 250 mmHg. Confirm the unit meets the specification for leak called out in the Repair Test Specification document. If the unit is leaking:

E. Pinch off the tubing leading to the pump. If this stops the leak, change the pump. **(Reference section 4.8 page 46)**
F. Pinch off the tubing leading to the valve. If this stops the leak, change the valve. **(Reference section 4.8 page 46)**
G. Pinch off the tubing leading to the transducer. If this stops the leak, change the Main PCB. **(Reference section 4.6 page 44)**

7. If the unit is inflating/deflating properly however there is no reading given, change out the main PCB. **(Reference section 4.6 page 44)**

8. **FOR THE SPO2 OPTION**: Connect the patient simulator to the unit SpO2 connection by the Nellcor SpO2 cable. Confirm readings equal to the specifications called out in the Repair Test Specifications document. If there is no reading, change out the SpO2 PCB. **(Reference section 4.7 page 45)**

9. **FOR THE TEMPERATURE OPTION**: Remove the temperature probe and view the temperature window on the display. Make sure the temperature is in the “monitor mode.” This will be displayed at the bottom of the window. If the unit is not in monitor mode, wait approximately 40-60 seconds and the unit will automatically transfer into the monitor mode. Using the Diatek 9600 calibrator set at 96.4 F/ 35.8 C or using a water bath between 84 F and 106 F, place the probe into the small hole on top of the 9600 calibrator or into bath. If there is no reading place the probe back into its housing, remove and retry. If there is still no reading, change the probe and retry the test. If there is still no reading place the probe back into the housing, unplug the probe and plug in the cal-key (5200-25), remove the probe and Confirm reading meets specifications called out on the Repair Test Specification document. If there is no reading at this point, change the temperature connector PCB and cable to the main PCB. **(Reference section 4.2 page 40)**

10. **FOR THE COMMUNICATION OPTION**: Select ***Tools|Options*** to insure that the communication port that the cable is connected to is selected. Select “test” and ensure that the Spot Device responds accordingly. If an error is present, ensure that there is no obstacles in the way of the IR window and re-try the test. If the error is still present, change out the main PCB. **(Reference section 4.6 page 44)**

End of section 3.1

3.2 Calibration Procedure : Voltage

VOLTAGE CALIBRATION

1. Connect the unit to the test station by hooking up the pneumatic tubing, and removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window. Adjust the power supply to 5.5 +0.2/-0 Vdc.
2. Place the unit into the "configuration test mode" by holding down the start button while powering up the unit. Allow the software versions to be displayed then press the mode button until the unit displays "BAT" in the LCD window.
3. Go to the repair software and choose ***Calibrate|Voltage***.
4. View the digital multi-meter (DMM) that is connected to the power supply reading the voltage. Move the cursor to the "Calibrated Voltage" box and type in the voltage that you observe on the DMM. In the software, select "Update."
5. The software will then prompt you to enter in a "Calibration Signature." Move the cursor to the box and enter the three initials of your name. Then select "OK."
6. At this point you should see the voltage on the LCD display of the unit change to match that of the DMM.

END OF SECTION 3.2

3.3 Calibration Procedure : Pressure

PRESSURE CALIBRATION

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window. Ensure that the voltage of the power supply is 6.5 +/- 0.2 Vdc.
2. Place the unit into the "configuration test mode" by holding down the start button while powering up the unit. Allow the software versions to be displayed then press the mode button until the unit displays "CAL" in the LCD window.
3. Go to the repair software and choose ***Calibrate***|***Manometer***.
4. Ensure that the valve is "open" and select "Calibrate 0."
5. Once this is completed successfully, close the valve by pressing the "start" button.
6. Ensure that the 500cc volume is the only volume in the system, and increase the pressure to 250 +/- 5 mmHg using the bulb and valve.
7. Place the cursor into the box below the "calibrate 0" button and type in the value of the pressure reading seen on the pressure meter.
8. Once completed, select "calibrate 250."
9. Select "OK" and the software will respond by asking "Are you sure?" and then asking for a calibration signature (your initials).
10. After placing your initials in to the dialog box. Select "OK" and the pressure calibration is complete. Cycle power to the unit for the changes in the calibration to take effect.

END OF SECTION 3.3

3.4 SELF DIAGNOSTIC FAULT CODES

The following is a list of all possible error codes and there meanings.

MAIN BOARD/BLOOD PRESSURE ERROR CODES

ERROR CODE	DESCRIPTION
C02	Auto-Zero Failure
C03	Inflation Too Rapid
C04	Excessive Inflation Time
C05	Excessive Noise
C06	Outside Measuring Range
C12	Ambient Temperature Out of Range
C13	Battery Failure
E10	Over Pressure Violation
E11	Internal Safety Violation
E20	Missed A/D Sample
E30	ROM Failure
E31	RAM Failure
E32	Factory EEPROM Checksum Failure
E33	User EEPROM Checksum Failure
E34	A/D Converter Failure
E35	SpO2 PCB Failure
E36	Temperature PCB Failure
E37	Printer Failure
E38	Real Time Clock Failure
E41	Stepper Valve Bad
E43	Event Log Erased

SpO2 ERROR CODES

ERROR CODE	DESCRIPTION
E7	Internal Malfunction
C9	10 Minute Diagnostic Limit Exceeded

TEMPERATURE BOARD ERROR CODES

ERROR CODE	DESCRIPTION
E0.1	Probe Heater Accumulator
E0.2	Probe A/D Pulse Width Error
E0.3	Adaptive Probe Gain too High or Low
Show “A” in Temperature display. Flash Up arrow.	Ambient Temperature too High
Show “A” in Temperature display. Flash Down arrow.	Ambient Temperature too Low
E0.6	Host system has violated the interface rules
E0.9	Rcal resistor pulse too long.
E1.0	Rcal resistor pulse too short
E1.1	PTB Resistor above 98.55ºF
E1.2	PTB Resistor below 98.15ºF
E1.4	Q Only turned heater circuit on
E1.5	C only turned heater circuit on
E1.6	Heater Circuit Error
E1.7	Heater temperature error
E1.8	Heater found on at end of pulse.
E9.1	Communication Error
Broken probe icon:	Broken or Missing Probe
“P”	Loss of Tissue Contact
C22	10 Minute Diagnostic Limit Exceeded

End of Section 3.4

3.5 COMPLAINT / CAUSE / CORRECTIVE ACTION

Troubleshooting: General Guide To Problems And Corrective Actions

QUICK GUIDE TO TAKING A MANUAL (AUSCULTATORY) BLOOD PRESSURE
Action:

1. Collect appropriate equipment.
   Use a certified accurate sphygmomanometer and quality stethoscope.
   Select a blood pressure cuff of a suitable size. Use a blood pressure cuff of the largest appropriate size for patient (see markings on inside of cuff).

2. Have the patient assume a comfortable position with the upper arm relaxed at heart level and the lower arm passively supported.

3. Expose the area of the brachial artery by removing clothing, or move a sleeve, if not too tight, above the area where the cuff will be placed.

4. Center the cuff bladder so that the lower edge is at least 1 inch (2.5cm) above the bend of inner arm of the elbow.

5. Palpate the brachial or radial pulse.

6. Inflate the cuff until the pulsation disappears. Then continue to inflate until the pressure reads 30 mmHg above the point where the pulse disappeared.

7. Listen carefully with stethoscope over brachial artery while controlling the release of air at a rate of 3 mmHg per second.

8. Systolic is determined by reading the manometer gauge when the first faint but clear tapping sound is heard with the stethoscope.

9. Diastolic, in adults, is determined by reading the manometer gauge to the closest even number when the last sound is heard.

10. Release the air quickly after at least 10 to 20 mmHg of silence.

11. Explanation:

a. Many sphygmomanometers are inaccurate. Low quality stethoscopes do not transmit sound well enough for blood pressure sounds to be heard accurately. A cuff that is either too large or too small will produce an inaccurate reading.

b. If the arm is not at the proper level, inaccurate readings will result

c. Clothing over the artery hinders the ability to hear and may cause inaccurate readings. Tight clothing may cause vessel congestion and inaccurate readings.

d. This places the cuff in the best position for occluding the blood flow through the brachial artery.

e. Determines the most accurate location for assessment and approximation of systolic pressure.

f. Facilitates identification of Phase One Korotkoff sounds.

g. One of the major sources of error in auscultatory blood pressure measurement is deflating the cuff too quickly. It is a normal operation of the Welch Allyn Spot Vital Signs to deflate at the American Heart Association recommended 3 mmHg per second.

h. Follows AHA recommended standards.

i. Diastolic blood pressure in children is the point at which the sound becomes muffled.

SYMPTOM: Inaccurate Blood Pressure Readings

Please note: Differences of up to 10mmHg should be considered normal and will occur for a number of reasons including intra-patient BP variability, observer hearing differences, and auscultatory deflation rate.

Possible Cause	Explanations and Corrective action
Incorrect cuff size. Note: Use Welch Allyn approved cuffs only.	Determine correct cuff size: Use reference markings on cuff. Measure patient's arm circumference midway between elbow and shoulder (see "Chart for Determining Cuff Size" on page 24 to select correct cuff size).
Patient's arm position.	Ensure patient's arm is at heart level.
Arm movement during blood pressure cycle.	Keep arm still during blood pressure cycle: • Movement may cause inaccuracies from artifact.
Blood pressure taken over clothing.	Blood pressure should be taken on a bare arm.
Arrhythmia.	Check for regularity of heart rate: (palpate pulse or check device) • Moderate to severe heart rate irregularities may make blood pressure difficult to measure.
Incorrect reference.	Use the correct Korotkoff sound to determine diastolic blood pressure. • Many listeners incorrectly equate diastolic blood pressure with the disappearance of sound only (phase 5). The Welch Allyn Spot Check Device was developed using the American Heart Association recommendations, which state that phase 5 be used unless sound continues to 0 mmHg, in which case the change in the quality of sound (phase 4) is to be used. Deflate cuff no faster than 3 mmHg per second. • One of the major sources of error in auscultatory blood pressure measurement is deflating the cuff too quickly. The American Heart Association recommends deflation no faster than 3 mmHg per second. Only use a sphygmomanometer that is known to be in calibration: • Blood pressure taken with an uncalibrated sphygmomanometer may be very inaccurate.
Change in blood pressure from auscultatory reading to Welch Allyn Spot Check Device reading.	Check blood pressure immediately prior to Welch Allyn Spot Check Device Reading.
Poor auscultatory sound recognition by observer.	Use higher quality stethoscope. Have a different observer check patient's blood pressure.

SYMPTOM: Cuff Inflation & Deflation with No Blood Pressure Reading Displayed (or error code in display)

Possible Cause	Explanations and Corrective action
Leak in pneumatic system.	Ensure all cuff attachments are tight. Carefully check for tubing leaks in blood pressure cuff and tubing attached to the device.
Arm movement during cycle.	Keep arm still during blood pressure cycle: • movement may cause inaccuracies from artifact.
Tubing movement artifact.	Do not contact tubing during blood pressure cycle: • movement may cause inaccuracies from artifact.

SYMPTOM: No Cuff inflation.

Possible Cause	Explanations and Corrective action
Connections between device and cuff loose.	Check all connections. (Do not over tighten).

SYMPTOM: Temperature Malfunction

POSSIBLE CAUSE		EXPLANATION AND CORRECTIVE ACTION
Error Code Displayed.	Broken probe.	Replace probe. Consult Technical Manual. Notify Biomedical department or Welch Allyn Technical Support. Wait for display window to read OrL, Aly, or Rec (as appropriate) before placing probe.
Low Temperature Readings.	Improper probe placement.	Place probe in most posterior sublingual pocket when in Orl mode. Notify Biomedical department or Welch Allyn Technical Support.
No Temperature Displayed.	Probe not replaced	Replace probe in holder prior to taking another temperature.

SYMPTOM: SpO2 Malfunction

POSSIBLE CAUSE		EXPLANATIONS AND CORRECTIVE ACTION
Sensor in place but No SpO_2 on Display.	Improperly attached sensor. Cable incorrectly plugged into device.	Insert the patient's finger completely into sensor. Ensure sensor cable is correctly plugged into device.
Inaccurate SpO_2 Reading.	Incorrect Sensor.	Ensure that correct manufacturers sensor is in use. • Use only Nellcor Puritan Bennett® sensors.

SYMPTOM: Printer Malfunction

Possible Cause	Explanations and Corrective action
Paper will not advance.	Consult printer Technical Manual. Notify Biomedical department or Welch Allyn Technical Support.

SYMPTOM: Device will not turn on

Possible Cause	Explanations and Corrective action
Low battery.	Check connections between device and transformer, and transformer and wall receptacle.
Device not powering up.	Unplug unit from wall receptacle and check for breaks in cord. If connections secure, check electrical outlet. • Charging Indicator will be on if connections are OK and the device is plugged into a working outlet. Notify Biomedical Department or Welch Allyn Technical Support.

SYMPTOM: Cuff Too Tight (Over Inflation)

Possible Cause	Explanations and Corrective action
Pressure Preset too high.	Check default Pressure Preset setting: (in Configuration Mode) • Unless patient has underlying systolic hypertension, set pressure preset at 160 mmHg. (If systolic blood pressure greater than pressure preset, the device will automatically increase an additional 40 mmHg)

SYMPTOM: Cuff popping off

POSSIBLE CAUSE	EXPLANATIONS AND CORRECTIVE ACTION
Inappropriate cuff size	Determine cuff size with the cuff markings or refer to chart in Operator's Manual for determining cuff size. • If cuff continues to pop off, notify Biomedical Department or Welch Allyn Technical Support.
Cuff applied inside out	Re- apply cuff: • Make sure Welch Allyn label is facing away from arm.

SYMPTOM: Cuff Deflating Too Slowly.

Possible Cause	Explanations and Corrective action
Normal operation	Typical time to take a reading is 20 to 45 seconds. 165 seconds is the maximum.

Pressure Preset too high	Check default Pressure Preset setting. (In Configuration Mode)
Patient movement	Have patient sit still. Do not have arm tight against chest wall as respiration may affect speed and accuracy of blood pressure measurement.
Small leak in pneumatic system	Check cuff and tubing for leaks.

Section 4 Removal/Replacement of Parts

4.1 Battery

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit.
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.

Reassemble in reverse order.

End of Section 4.1

4.2 Temperature Pod and Temperature Connector PCB removal

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the #10 Torx screws from the temperature connector PCB using T112917 with the #10 Torx bit (T114030). Aside the temperature connector PCB.
9. Remove the temperature probe housing by removing the two #10 Torx screws using T112917 with the #10 Torx bit (T114030). Aside housing.

Reassemble in reverse order

End of section 4.2

4.3 Front Housing and Switch Array

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing.
11. Remove the switch array from the front housing. Aside Front Housing.

Reassemble in reverse order

End of Section 4.3

4.4 Display PCB

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing and aside housing.
11. Gently lift the LCD module from its post.
12. Roll the LCD to the left and set on the bench beside the Spot unit.
13. Remove the flex cable from the LCD and aside the display.

Reassemble in reverse order

End of Section 4.4

4.5 Remove Power and Battery Cable

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing and aside housing.
11. Gently lift the LCD module from its post.
12. Roll the LCD to the left and set on the bench beside the Spot unit.
13. Remove the flex cable from the LCD and aside the display.
14. Disconnect the power cable from the main PCB by pushing down on the tab and pulling toward the bottom of the unit.
15. Lift ferrite from it holder.
16. Using a T114135 3/8” Hex socket attached to T112918A, remove the nut from the transformer connector and slide the cable through the rear housing opening.
17. Slide the battery connector out of the rear housing and aside the cable assembly.

Reassemble in reverse order

End of Section 4.5

4.6 Main PCB Removal

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing and aside housing.
11. Gently lift the LCD module from its post.
12. Roll the LCD to the left and set on the bench beside the Spot unit.
13. Remove the flex cable from the LCD and aside the display.
14. Disconnect the power cable from the main PCB by pushing down on the tab and pulling toward the bottom of the unit.
15. Remove the pneumatic tubing from the transducer on the PCB.
16. Remove the battery/Valve cable connector from the bottom of the PCB.
17. Remove the 4 #10 Torx screws from the PCB using T112917 with the #10 Torx bit.
18. Lift Main PCB from housing and aside.
19. If unit has SpO2, remove the SpO2 Module from defective Main PCB and add to new Main PCB.

Reassemble in reverse order

End of Section 4.6

4.7 SpO2 PCB Removal (If configured with SpO2)

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing and aside housing.
11. Gently lift the LCD module from its post.
12. Roll the LCD to the left and set on the bench beside the Spot unit.
13. Remove the flex cable from the LCD and aside the display.
14. Disconnect the power cable from the main PCB by pushing down on the tab and pulling toward the bottom of the unit.
15. Remove the pneumatic tubing from the transducer on the PCB.
16. Remove the battery/Valve cable connector from the bottom of the PCB.
17. Remove the 4 #10 Torx screws from the PCB using T112917 with the #10 Torx bit.
18. Lift Main PCB from housing and aside.
19. Remove the 3 Phillips head screws along with the nuts and spacers form the SpO2 PCB. Use T112918 with the Phillips bit (T112919) and needle nose pliers.
20. Remove the SpO2 module (Nellcor MP205) from the main PCB and aside.

Note: ***Remember to ensure that they are two shunts at the top of the jumper row on the Nellcor MP205 PCB Before you install onto the Main PCB. Further, ensure that the two locking tabs on the connectors of the Nellcor MP205 PCB are broken off before installing onto the Main PCB. Ensure, also, that the nylon washers are located on the main PCB when reassembling the SpO2 PCB to the Main PCB.***

Reassemble in reverse order

End of Section 4.7

4.8 Pump and Valve Removal

1. Lay unit face down on the test bench
2. Remove the 4 Phillips head screws holding the battery cover/handle to the unit using T112918 with the #4 Phillips bit (T112919).
3. Lift handle/cover and aside.
4. Lift battery from housing and disconnect the Molex connector.
5. Remove 3 #10 Torx Screws from the temperature pod using T112917 with the #10 Torx bit (T114030).
6. Roll temperature pod toward top of the unit and place on test bench.
7. Unplug the flex cable from the temperature connector PCB and aside the temperature pod.
8. Remove the 4 Phillips head screws using T112918 with the #4 Phillips bit (T112919).
9. If equipped with SpO2, remove and aside the SpO2 cable clip.
10. Remove the tubing from the front housing and aside housing.
11. Gently lift the LCD module from its post.
12. Roll the LCD to the left and set on the bench beside the Spot unit.
13. Remove the flex cable from the LCD and aside the display.
14. Disconnect the power cable from the main PCB by pushing down on the tab and pulling toward the bottom of the unit.
15. Remove the pneumatic tubing from the transducer on the PCB.
16. Remove the battery/Valve cable connector from the bottom of the PCB.
17. Remove the 4 #10 Torx screws from the PCB using T112917 with the #10 Torx bit.
18. Lift Main PCB from housing and aside.
19. Remove the pneumatic tubing from the valve and the pump.
20. Remove the valve and the pump from their respected location on the rear housings and aside

Reassemble in reverse order

End of Section 4.8

Section 5 Test Procedures

Section 5.1 Calibration Tests

ABSTRACT: The following are the test procedures for the Spot Vital Signs. We set this procedure up so that you can start at section 5.1 and go straight through the procedure or you can skip around. However, you must do all of the test called out in this section before a unit can be returned to field service.

NOTES:
A. The word "unit" in this text refers to the Spot Vital Signs.
B. "***Menu|Choice"*** represents menu commands. Rather than use the phrase "choose the Exit command from the File menu."

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Place the unit into the "configuration test mode" by holding down the start button while powering up the unit. Allow the software versions to be displayed then press the mode button until the unit displays "CAL" in the LCD window. The unit will automatically perform a auto zero once "CAL" is displayed.
3. Attach a pneumatic clamp to the 100cc and the 250cc volume, remove the clamp from the 500cc volume.
4. Select ***Test|Calibration***. The dialog box will display the unit manometer reading, unit battery reading, valve and pump status.
5. Use Start button to close valve of the unit, and hand bulb to set the pressures.
6. Verify that the unit is within calibration specification at all the following target pressures: 0, 50, 175, 275 mmHg. All target pressures have a tolerance of +/- 5 mmHg. Specification are found in the Repair Test Specifications document.
7. Press the "mode" button until the LCD window reads "bat."
8. Set the power supply to 5.5 + 0.2/- 0 Vdc (5.5 to 5.7 Vdc). Verify that the voltage reading of the unit meets specification called out in the Repair Test Specification document. Return the power supply to 6.5 Vdc upon completion of this test.
9. Select "OK" to exit from the "Test Calibration" dialog box.

End of Section 5.1

Section 5.2 Current Tests

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Power down unit then re-power unit allowing the unit to boot up into its normal mode.
3. Select ***Test|Current Levels***. Check the following current levels:
   a) Blank
   b) Back Light
   c) Valve/Pump
   d) SpO2 Mode
4. Verify these currents meet the specifications called out in the Repair Test Specification document.
5. Select “OK” to exit dialog box.

End of Section 5.2

Section 5.3 Noise Levels

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Click on ***Test|Noise Levels***.
3. Press Test button to retrieve the units internal pressure channel noise level. Verify that the noise level meets the specification called out in the Repair Test Specification document.
4. Select “OK” to exit dialog box.

End of Section 5.3

Section 5.4 Button Test

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Choose ***Test|Button Test***. Press each button and ensure that the computer acknowledges it, via the "Button Pressed" display.
3. Select "OK" to exit from dialog box.

END OF SECTION 5.4

Section 5.5 Interface Test

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Select *Test|Display* in the repair software.
3. Select “all on” in the LCD Display section and ensure that all the segments are lit on the unit.
4. Select “all off” in the LCD Display section and ensure that all the segments are not lit on the unit.
5. Select “normal” in the LCD Display section to return the display to normal.
6. Select “on” in the Back-light section and ensure light comes on.
7. Select “off” in the Back-light section and ensure light goes off.
8. Select the buzzer test and ensure that the buzzer of the Spot Device is “on.” Select “OK” to exit test and turn off the buzzer.
9. Select “OK” to exit dialog box.

End of Section 5.5

Section 5.6 Print Quality

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Ensure that you have the HP IR printer that work with the Spot Vital Signs.
3. Choose ***Test|Print Quality***. Choose "test pattern 1." The printer will print out a pattern of large and small ASCII characters. Verify the quality of the printer output. Once test 1 is complete, choose test pattern 2. The printer will print out a solid gray field. Verify the quality of the printer output.
4. Select "OK" to close the box.

<u>Note:</u> This test can only be completed if using the TTL service port. This test can not be completed if the tester is using IR for communication. Further, if print quality is poor, change out the AA batteries of the printer and re-test.

End of Section 5.6

Section 5.7 Pneumatic Tests

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Select ***Test***|***Pneumatic***, and then the "Leak Test" option. The software will test for leak and will give you a Pass or Fail indication.
3. Select the "Dump Test" option. The software will automatically test for the dump speed and will give you a Pass or Fail indication.
4. Select the "Inflation Test" option. The software will automatically test for the inflation time and give you a Pass or Fail indication.
5. Select "Valve Control Test" option. The software will automatically test to ensure that the unit can control the valve and ensure that the valve is good.
6. Select "OK" to exit the dialog box.

End of Section 5.7

Section 5.8 SpO2 Tests

1. Connect the Nellcor SpO2 simulator (SRC2) to the unit with the test cable.
2. Ensure that the following are the settings of the simulator:
    a) Rate: 112
    b) Light: High 1
    c) Modulation: High
    d) RCAL Mode: RCAL63/Local
3. Verify the reading of the unit meets requirements when compared to the Repair Test Specification.
4. Reconnect the SpO2 sensor. Place the sensor onto your finger. The unit should return a reading if the sensor is OK.

End of Section 5.8

Section 5.9 Temperature Tests

1. Disconnect the temperature probe from the unit leaving the probe itself in its housing. Place the "CAL key" into the connector. Remove the probe from the housing. The temperature should read 97.3 F +/- .2 F. Remove the "cal" key and reconnect the probe.
2. Make sure that the unit's temperature option is in the "monitor mode". Do this by removing the probe from the housing and observing the temperature display. "Monitor mode" should be seen in the lower right hand side of the display. If this is not seen, wait approximately 30 - 45 seconds and the unit will change mode to the "monitor mode."
3. Set up the Diatek 9600 calibrator. Set the calibrator to 96.4 F or use a water bath between 84 F and 106 F. Allow the calibrator to stabilize for three (3) minutes. Place the probe into the small hole in the calibrator. Observe the temperature display, The reading should be 96.4 F +/- .3 F within 30 - 45 seconds.
4. Place the probe back into the housing. Set the calibrator to 106 F. Allow the calibrator to stabilize for three minutes. Remove the probe from the housing, the unit must be in the monitor mode, if not wait until the unit is in that mode. Place probe into the small hole at the top of the calibrator. The reading should be 106 F +/- .3 F within 30 - 45 seconds. If using a water bath skip this part of the test.

End of Section 5.9

Section 5.10 Fail Safe Testing

1. Connect the unit to the test station by hooking up the pneumatic tubing, removing the battery and connecting the power supply. Ensure that there are no obstacles in the way of the IR window.
2. Place the unit into the “configuration test mode” by holding down the start button while powering up the unit. Allow the software versions to be displayed then press the mode button until the unit displays “CAL” in the LCD window.
3. Ensure that the unit is connected to the 500cc volume.
4. Press the “start” button to close the valve.
5. Increase pressure on the unit until E10 appears in the LCD screen. Record the highest pressure observed on the pressure meter.
6. Press the “cancel” button to return the unit to “CAL” mode.
7. Press the “start” button to close the valve.
8. Apply 70 mmHg to the unit and start a timer.
9. When the unit returns a E11, stop the timer and record the time.

End of Section 5.10

Section 5.11 Check List For Spot Vital Signs Service Work

General Data

Repair Number	Date	Tech	Unit SN	Life Cycle Count	Model

Repair Data:

Check all items repaired/replaced and record serial # where possible:

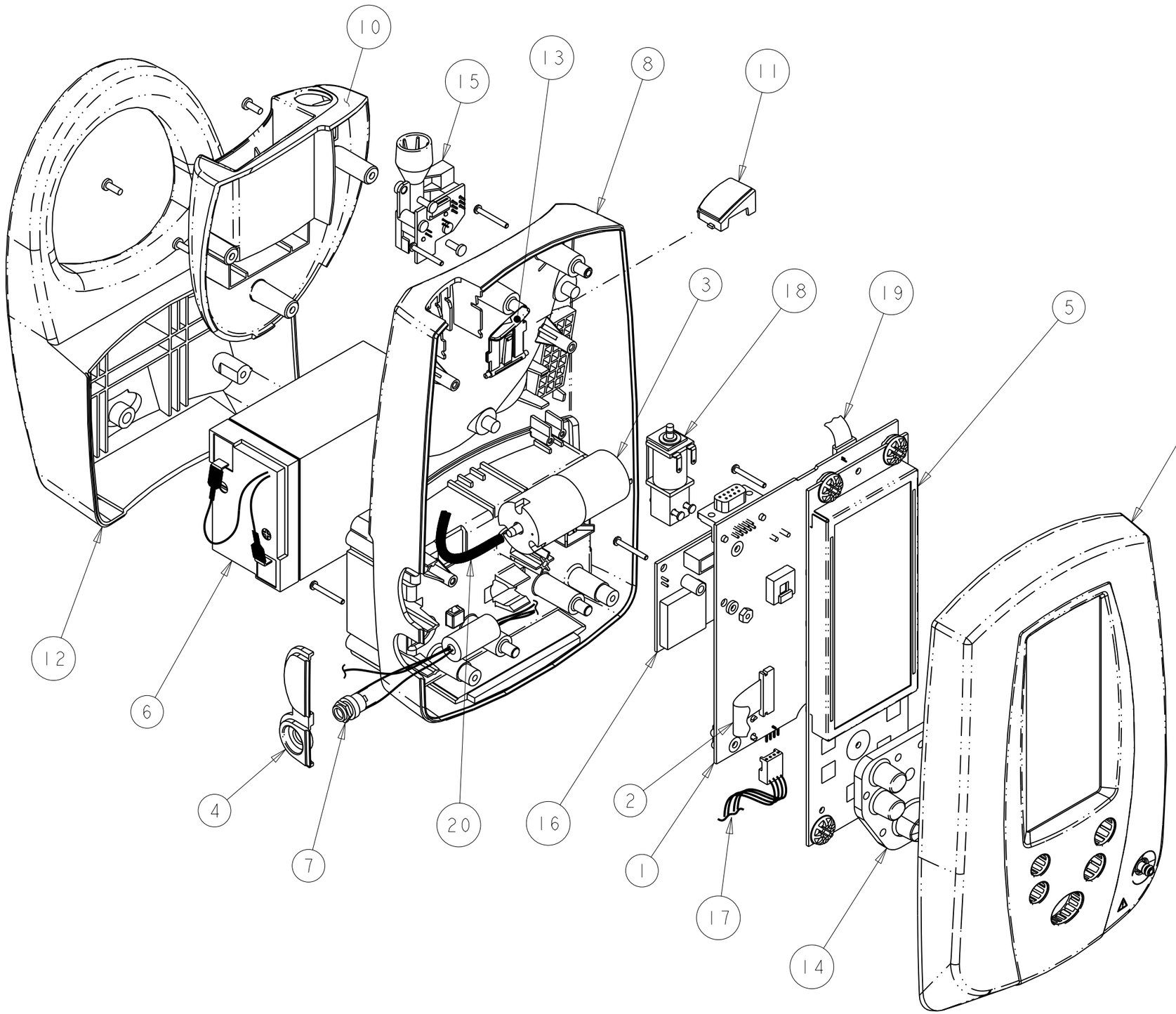
Items	Repair or Replaced	Serial Number or Lot Number
Main PCB		
Display PCB		
Temp. Connector PCB		
SpO2 PCB		
Valve		
Pump		
Pneumatic Tubing		
Power Harness		
Pump and Valve Wire Harness		
Battery		
Front Housing		
Rear Housing		
Temperature Pod		
Temperature Probe		
SpO2 Sensor		

Test Information	**Test Data**	**Test Specifications**
Unit SW Version		
SpO2 SW Version		
Test Pressure @ 275 mmHg		+/- 5 mmHg
Unit pressure @ 275 mmHg		+/- 3 mmHg
Test Pressure @ 175 mmHg		+/- 5 mmHg
Unit Pressure @ 175 mmHg		+/- 3 mmHg
Test Pressure @ 50 mmHg		+/- 5 mmHg
Unit Pressure @ 50 mmHg		+/- 3 mmHg
Test Pressure @ 0 mmHg		+/- 1 mmHg
Test Pressure @ 0 mmHg		+/- 1 mmHg
Test Voltage		6.0 + 0/-0.2 Vdc
Unit Voltage		+/- 0.05 Vdc
Blank Current		<= 200 mA
Back Light Current		<= 400 mA
Valve/Pump Current		<= 700 mA
SpO2 Current		<= 120 mA
Noise Level		<= 0.05 mmHg
Button Test		Pass/Fail
Interface Test		Pass/Fail
Print Quality (If applicable)		Pass/Fail
Unit Leak		<= 5 mmHg in 15 seconds.
Unit Dump Time		<= 10 seconds
Unit Inflation Time		<= 7 seconds
Valve Control Test		Pass/Fail
Over Pressure Test		296 mmHg to 329 mmHg
Over 15 mmHg Test		<= 180 seconds
SpO2 Simulator Reading		81% +/- 3%; 112 BPM +/- 3 BPM
SpO2 sensor Reading		Pass/Fail
Temperature Calibration Reading (96.4 F))		96.4F+/-0.3F (35.8C+/-0.2C)
Temperature Calibration Reading (106 F)		106F+/-0.3F (41C+/-0.2C)
Temperature Cal Key Reading		97.3F+/-0.2F (36.3C+/-0.1C)

Section 6 Drawings

- **6.1....Exploded view of Spot Vital Signs**
- **6.2....Electrical schematics**

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	AMT41550-36	TJW	1/7/01	



SEE REPAIR PARTS LIST IN SECTION 2 OF THE SPOT SERVICE MANUAL (95P506E) FOR DESCRIPTIONS

-	-
PART NO.	DESCRIPTION

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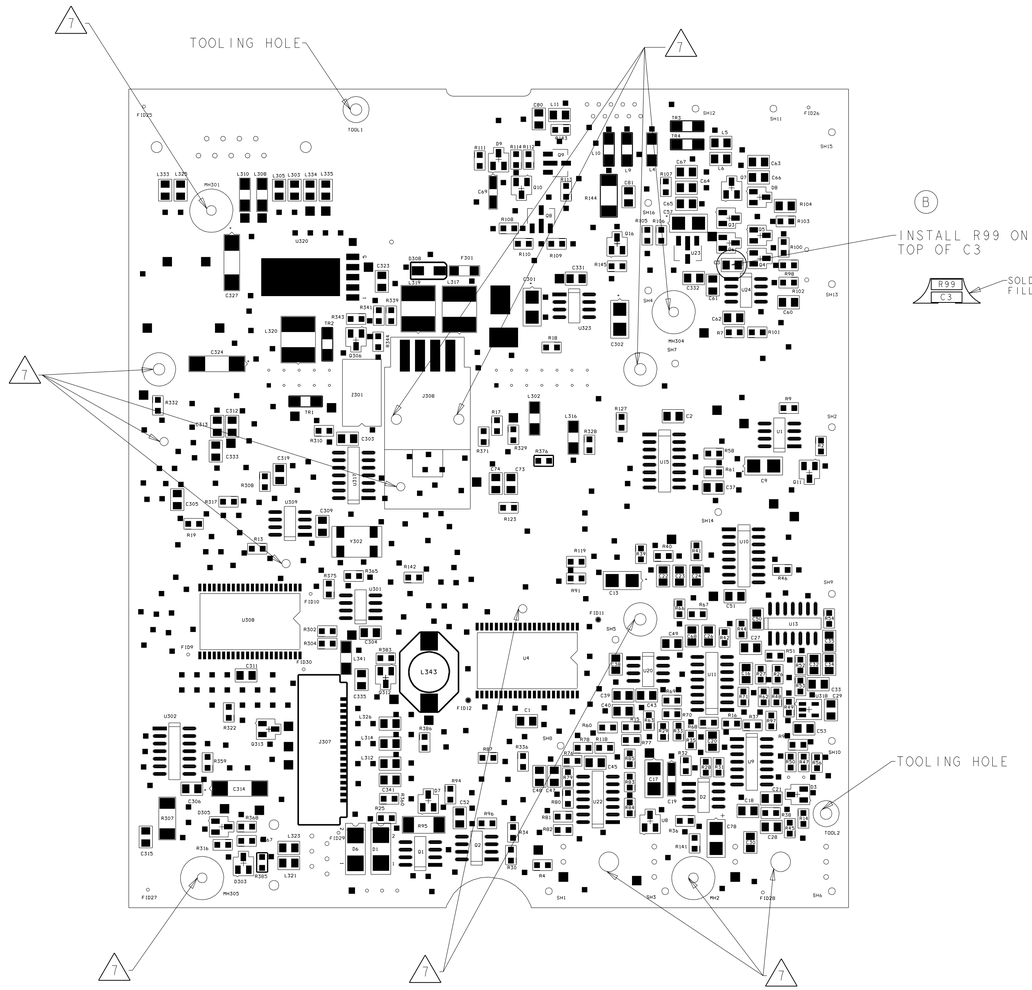
DRAWN: TJW	DATE: 01-Feb-01	Welch Allyn®
APPROVED: -	DATE: -	MATERIAL: -
REL TO PROD: -	DATE: -	FINISH: -
-	-	TITLE: SERVICE REPAIR PARTS
CAD SOFTWARE:	ProE	
TRANSLATED FROM:		

UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

B	DRAWING NO. 421216	REV A
SCALE 0.500	SHEET 1 of 1	

REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	AMT41550-3	JRS	9/5/00	T.W.
B	CHG S/N LABEL LOCATION; ADD NOTE 8; ADD P/N: -502; ADD "INSTALL R99 ON TOP..."	AMT41550-37	ASK	2/28/01	-



REV	DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRODUCTION	AMT41550-3	WNC	09-27-00	KNUT SPANG
	CHANGE C57 TO 1uF				
B	ADD R99	AMT51550-25		12-19-00	

Failsafes and Optional Populations

GNDD

THIS MESS TIES GNDS TOGETHER. MUST BE AT TOP LEFT ON EVERY PAGE. THANKS ORCAD

15mm

330mm

PTRANS

GT_15MM

LT_15MM

LT_330MM

AUTO

PUMP

C1RC

R58 1M

C1P1

C1OSC1

R61 162K

C1OSC2

C37 0.01uF

C1OUT

U15 14060B

C8 .047uF

C1 .047uF

U18A 4013

C1_OK

C36 .047uF

74HC02 U14A

/INFLAT

C59 .047uF

U17A 74HC00

INFLAT_OK

U14B 74HC02

R125 1M

INFLATE_FAIL

U17B 74HC00

R74 1K

OVP_FAIL

C2 .047uF

U19A 74HC74

FCLR

R124 1M

C41 100pF

C7 .047uF

U21 14060B

C2RC

R64 1M

C2OSC1

R65 261K

C2OSC2

C42 0.033uF

C2OUT

U18B

U18_TEST 4013

R73 1K

LONG_FAIL

R123 1M

U14C 74HC02

/FAIL1

U14D 74HC02

/FAIL2

U17D 74HC00

FAIL

U17C 74HC00

/FAIL

/FAIL

U19B 74HC74

WD_FAIL

/RES

U19_CLR_TEST

R72 1K

R127 1M

R60 1K

C38 100pF

15MM_OUT

R62 100K

>15MM DETECT

15MM_IN

15MM (11.9MMHG)

R63 100K

15MM_REF

C39 .047uF

U20A

LM393

C49 .047uF

C40 100pF

+4VA

R66 1K

R67 10K

R68 887

(300.37MMHG) 3.75V

30MM

R69 100K

300MM_REF

R70 13.3K

C43 .047uF

U20B

LM393

30MM_OUT

C68 100pF

30MM_IN

R71 100K

+5VA

+1VAS

U22A

XDPWR

XD1

NE5234

C47 1000PF

XD_FB

FPNS-07PGR

C48 1000PF

R82 1.96K

XD+

XD-

IAFB+

IAFB-

R79 133K

R80 10K

R81 133K

U22C NE5234

U22D NE5234

IAI+

IAI-

R76 10K

R84 10K

IAO+

IAO-

R77 68.1K

R78 68.1K

R83 68.1K

R85 68.1K

U22B NE5234

+2VA

STRANS

R118 100K

Secondary XDCR

Temperature Hardware 678

TEMPERATURE A/D CONVERTER

U23 RH5RE24AA-T1

+5VA

VIN

NC

VOUT

VREFTEMP

C332 .047uF

C57 1uF

R98 4.64K

ADB1

Q4 MMBT5087

C58 0.33uF POLY

AD_DC 2

C44 0.33uF Tantalum

AD_TRIGGER

R100 10K

ADB2

Q5 MMBT2222A

R99 1K

C3 0.01uF

U24 TLC555CD

C61 0.01uF

CTRL

TRG

THR

DSCH

OUT

AD_DSCH

R102 1K

C60 1000PF

R7 4.64K

R101 1K

AD_OUT

C62 100pF

C63 0.01uF

RES

R103 12.1K

R104 11.55K 0.05%

CALD

PTBD

D8 MMBD1203

Q3 BSS138

RCAL_F

R105 1K

RCAL_SEL

C64 100pF

L5

L6

PRBD

Q6 BSS138

PTBCAL_F

R106 1K

PTBCAL_SEL

C65 100pF

Q7 BSS138

PRBSEL_F

R107 1K

PROBE_SEL

C67 100pF

C66 0.01uF

This cap not populated in 678

TEMPERATURE POD

PAT_RES

PAT_PRBD

PRBHT

PAT_PROBE_0

PAT_PROBE_1

PRBSWGND

TEMP_POD_SENSE

PROBE_LED_ON

PAT_PROBE_SW

PRBGND

J1

PROBE_SW

R143 10K

R145 100K

Q16 IRLML6402

/PROBE_LED_ON

C80 0.01uF

L11

L9

L4

L7

L8

TR3 14V 0.4j

TR4 14V 0.4j

L10

L12

PRB_LED_2

PRB_LED_ON

R144 82

C81 0.01uF

R116 1M

R117 1M

POD_SENSE

PROBE_1

PROBE_0

C71 0.01uF

C72 0.01uF

R146 1K

/POD_SENSE

Q17 MMBT3904

PROBE CONNECTOR PCA

PROBE THERMISTOR

J1-A1

J1-B1

R108 1K

/HTRQ

HTB1

Q8 BCX69

HTRPWR

HTAMP

R109 46.4K

HTRQS

R110 46.4K

D9 MMBD1203

R111 3 MEG

R112 1K

HTB0

HTB2

Q9 BCX69

R114 1K

/HTRC

Q10 MMBT5087

HTRC2

R113 46.4K

R1 2.7

PRBHTR

L3

PRBHT

R115 4.64K

C70 0.01uF

C69 1uF

160mA 160^2 * 2.7 = 71mW

PROBE WARMER

WELCH ALLYN PROBE CONNECTIONS

J1-A2

27

PROBE HEATER RESISTOR

J1-B2

CUT HERE FOR RECTAL

J1-B3

J1-A3

CUT HERE FOR CAL KEY

	PROBE_0	PROBE_1
ORL	0	0
REC	0	1
CAL	1	0
NO PROBE	1	1

PRBD PIN1 (B1)

PIN 2 (B2) GND

PROBE_1 PIN 3 (B3)

B1 B2 B3 A1 A2 A3

RES PIN 6 (A1)

PRBNT PIN5 (A2)

PROBE_0 PIN 4 (A3)

PROBE CONNECTOR (TOP VIEW)

FAILSAFES / TEMPERATURE

REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPRV

DRAWN WILL CUIPYLO — DATE 09-06-00

APPROVED KNUT SPANG — DATE 09-06-00

REL TO PRODUCTION <REL TO PRODUCTION> — DATE 09-27-00

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TITLE: SPOT CHECK MAIN PCB

Copyright Wednesday, February 28, 2001

Size D — DWG NO 421102 — Sheet 1 of 3 — Rev B

MOD B

REV	DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRODUCTION	AMT41550-3	WNC	09-27-00	KNUT SPANG
B	CHANGE C57 TO 1uF ADD R99	AMT51550-25		12-19-00	

ANALOG VOLTAGE REGULATOR

THIS MESS TIES GNDS TOGETHER. MUST BE AT TOP LEFT ON EVERY PAGE. THANKS ORCAD

U1 TPS7250Q: RESET/PG, IN, /BPEN, EN, GND, SENSE/FB, OUT, +5VA; C9 10uF

U6 TPS7350QPWR: IN, /BPEN, EN, NC, RESET, SENSE, OUT, GND; C12 10uF; R132 10K; C77 .047uF; /RES

R9 10K; R2 100K; Q11 MMBT3904; BPEN, BPENB

DIGITAL VOLTAGE REGULATOR

Micro

U2 H8/3042

Vcc, Vcc, Vcc; C5 .047uF

NIBP_PWM_ADC; AD_OUT; /HTRC; DCLK_BB; PROBE_SW; AD_TRIGGER; /HTRG; TXD1_BB; PUMP; PROBE_SEL; NIBP_OFFSET_DAC; PTBCAL_SEL; NIBP_ADC_CLOCK; RCAL_SEL; VALVE; CSEE

R142 10K

TXD0; TXD1; RXD0; RXD1; DCLK0; DCLK1

+5VA, +2VA; R15 10K +2VA_MCU; R16 10K +4VA_MCU; PROBE_0; PROBE_1; R136 10K; /PROBE_LED_ON; PROBE_1MOD

C13 10uF; C14 .047uF

/PRINT; /PRINT (/BOOTSTRAP)

LONG_FAIL; OVP_FAIL; HTRPWR

R24 10K; /RES; FLASH_RESET

RESET, RESO, STBY, MD0, MD1, MD2, NMI, AVref, AVcc, AVss

P90/TxD0, P91/TxD1, P92/RxD0, P93/RxD1, P94/SCK0/IRQ4, P95/SCK1/IRQ5

P70/AN0, P71/AN1, P72/AN2, P73/AN3, P74/AN4, P75/AN5, P76/AN6/DA0, P77/AN7/DA1, P10/A0

P80/RFSH/IRQ0; P81/CS3/IRQ1; P82/CS2/IRQ2; P83/CS1/IRQ3; P64/CS0

P60/WAIT; P61/BREQ; P62/BACK; P63/AS; P64/RD; P65/HWR; P66/LWR

AMUX_A1; AMUX_A2; AMUX_A3; /RD; /HWR; /LWR

EXTAL, XTAL, CK; Y1 16.000 Mhz; C74 10PF; C73 10PF

EMULATOR_HOLE, EMULATOR_SHIM

P40/D0 … P47/D7; P30/D8 … P37/D15

P11/A1 … P17/A7; P20/A8 … P27/A15; P50/A16; P51/A17; P52/A18; P53/A19

RXD1_BBMOD; FCLR; /IFAIL; AUTO_MOD; AUTO

Flash

U5 AM29F400BB-70EC TSOP48: A0(17) … A17, DQ0 … DQ14, A-1/DQ15, /ROM_CS, /RD, /HWR, FLASH_RESET, BYTE, RY/BY, NC, RESET

RAM

U4 IDT71016: A0 … A15, /CS1, /RD, /WR, /UB, /LB, CS, OE, WE, BHE, LHE

D[0:15]; D0, D1; R119 10K; R91 10K; R121 10K; R122 10K

C4 .047uF; C6 .047uF

R21 10K; R22 10K; R23 10K; /CS3; /CS2; /CS1

R87 1K; R133 10K

EEPROM

U7 93C56: ORG, CK, DI, CS, VCC, DO, GND; DCLK_BB; TXD1_BB; CSEE; RXD1_BB; RXD1_BBMOD; R135 100; R92 10K; C15 .047uF

Address Decoding

C10 .047uF; /CS3; /CS2; U3A 74HC08; /ROM_CS

/LWR; /RD; U3B 74HC08; /LB

/RD; /HWR; U3C 74HC08; /UB

/HWR; /LWR; U3D 74HC08; /WR

PUMP / VALVE DRIVE

D6 MRA4003T3; PUMP+, PUMP-, VALVE+, VALVE-; TP23; PUMP / VALVE

PUMP; R96 10K; Q1B SI9945DY

R25 100; SNUB1; D1 MRA4003T3

REPLACE C52 WITH 0 OHM JUMPER FOR PNEUTRONICS VALVE

VALVE; C52 0.1uF; VALVEAC; Q1A SI9945DY

R30 100K; D7 MMBD1503A; R94 464K; R95 33; VALVEHOLD

/SAFE; Q2A SI9945DY

R34 10K; Q2B SI9945DY; /FAIL

Analog Reference

U25 OPA353NA; +2VREF; XD_OUT; R139 7.5K; XD_BASE; Q14 MMBT3906; XD_DRAIN

/BPEN; R129 10K; Q15 BSS84; BP_DRAIN; R137 20; +VX

C79 .047uF; R138 4.64K; R131 0; C75 .047uF; R140 15K; XD_PS_FB; R141 10K; C78 10uF

C17 4.7uF; C18 .047uF; +5VA, +4VA, +2VA

R28 13.3K; R31 51.1K; R32 12.1K; R36 7.5K; +2V; +2VDIV; D2 LM385M; C19 1uF

U9B NE5234; U9A NE5234; R29 909; 15BIM; R33 110; +1VA; R14 1K; +1VAS

+4VFB; R35 100K; R37 100K; C20 0.01uF; C21 .047uF; R38 1K

MAIN

Batt Sense

+BAT; BAT SENSE; R26 1M; BATT; R27 1M; C16 .047uF

Temp

+5VA; TEMP SENSOR (10mV / C * Temp C) + 500mV; U8 LM50B: +Vs, GND, Vo; TEMP

Primary XDCR

+5VX; R43 3.83K; Primary Transducer; 0mmHG = 0.5V; 300mmHG = 4.0V; Gain and Comp; P1_2_OUT; P1_6; P1 XFPM-050KPG-P1; C30 0.1uF

Op-Amp and DC Offset

+4VA; R45 56.2K; C28 .047uF; R97 1M; PTRANS_SUM; U9D NE5234; PTRANS; R48 237K; NIBP_FF

Zero Adjust +/-20mmHg range

Offset

+5VA; R51 1K; NIBP_OFFSET_DAC; TIOCA0 Hitachi pin 95; NIBP; U13B 74HC00; /NIBP; C50 .047uF; C34 100pF; PWM D/A 64.0KHz

R52 100K; /NIBP_F; R53 100K; C32 0.1uF; C33 0.1uF

SHIELD_HOLE SH1 … SH16; MH2; MOUNTING_HOLE

Shield

MUX

U10 MC74HC174A: /NIBP_CK, CLK, Vcc, RESET, D0 … D5, GND, Q0 … Q5; +5VA; C51 .047uF

AMUX_A1; AMUX_A2; AMUX_A3; R39 1K; R40 1K; R41 1K; C22 100pF; C23 100pF; C24 100pF

A/D Mux

U11 4051: INH, A, B, C, VEE, VSS, VDD, X0 … X7; MX_A1; MX_A2; MX_A3; STRANS; PTRANS; BATT; TEMP; +5VA2; +1VA, +2VA, +4VA; R42 10K; C27 .047uF; R44 10K; C26 .047uF; MUX_OUT

Module B PWM A/D Converter

Integrator

U9C NE5234; INT_OUT; R47 3.48K; INT_O; R50 93.1K; INT_FB; C31 .01uF POLY; R56 14.7K; PRECHG; D3 MMBD1503A; NIBP_ADC_CLOCK; R54 1K; U13C 74HC00; /NIBP_CK; U13D 74HC00

PWM A/D Converter

Comparator

R93 3.48K; MUX_FB; C53 680pF; U318 OPA353NA; C29 .047uF; /CONVERTING; U13A 74HC00; PWM_ADC; R46 1K; NIBP_PWM_ADC; R49 464K; /AD_PRECHARGE

TP3, TP4, TP; R4; RXD0, TXD0, BPEN, AUTO, PROBE_SW

TP2, TP1, TP; J308 BATTERY / CHARGER: BATTIN, BATGND, CHGIN, CHGND; TR1 14V 0.4j; TR2 14V 0.4j

DRAWN	WILL CUIPYLO	DATE	09-06-00	**Welch Allyn**			
APPROVED	KNUT SPANG	DATE	09-06-00	THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF WELCH ALLYN, INC. AND SHALL NOT BE REPRODUCED, OR COPIED, OR USED AS A BASIS FOR SALE OR MANUFACTURE OF EQUIPMENT OR DEVICES WITHOUT WRITTEN PERMISSION.			
REL TO PRODUCTION	<REL TO PRODUCTION>	DATE	09-27-00	TITLE	SPOT CHECK MAIN PCB		
Copyright Wednesday, February 28, 2001				Size D	DWG NO 421102	Sheet 2 of 3	Rev B

REV	DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRODUCTION	AMT41550-3	WNC	09-27-00	KNUT SPANG
	CHANGE C57 TO 1uF				
B	ADD R99	AMT51550-25		12-19-00	

SPOT MAIN SECTION

THIS MESS TIES GNDS TOGETHER. MUST BE AT TOP LEFT ON EVERY PAGE. THANKS ORCAD

CONFIGURATION

REAL TIME CLOCK

MEMORY SELECTOR

AM29F400BB-70EC TSOP48 PROGRAM MEMORY

uPROCESSOR

SPOT POWER SECTION

SPOT I/O SECTION

BAR CODE / SERVICE

SPO2 PCB CONTROL

Pin 6 low for Seimens
Pin 14 low for Nellcor

LCD RIBBON

SPO2 BOARD TO DB9

SPO2 DB9

SPARE

BACKLIGHT

SPOT MOUNTING HOLES

MOUNTING_HOLE MH304
MOUNTING_HOLE MH305
MOUNTING_HOLE MH301

SPOT

REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPRV

DRAWN WILL CUIPYLO — DATE 09-06-00
APPROVED KNUT SPANG — DATE 09-06-00
REL TO PRODUCTION <REL TO PRODUCTION> — DATE 09-27-00

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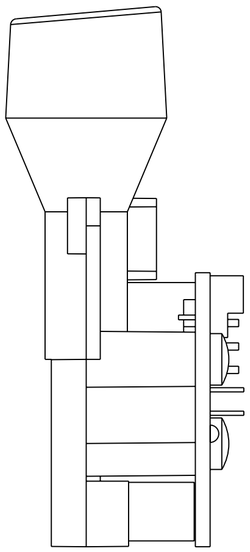
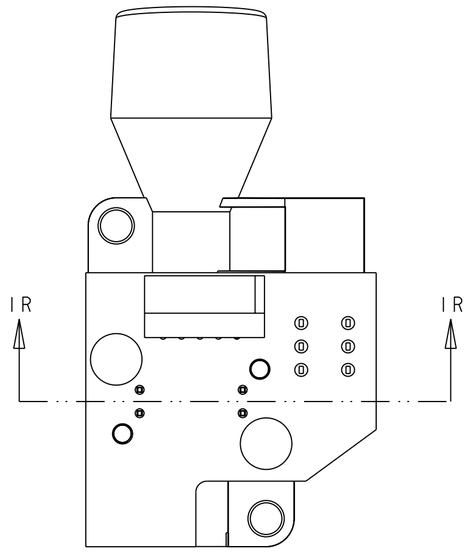
TITLE: SPOT CHECK MAIN PCB

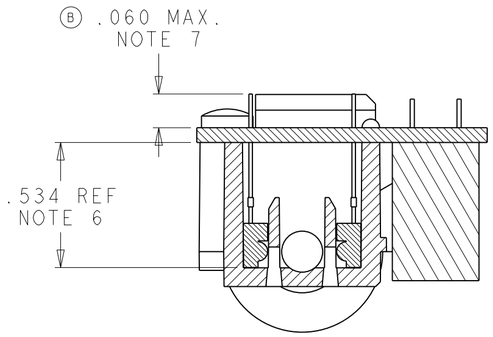
Copyright Thursday, December 28, 2000

Size D — DWG NO 421102 — Sheet 3 of 3 — Rev B

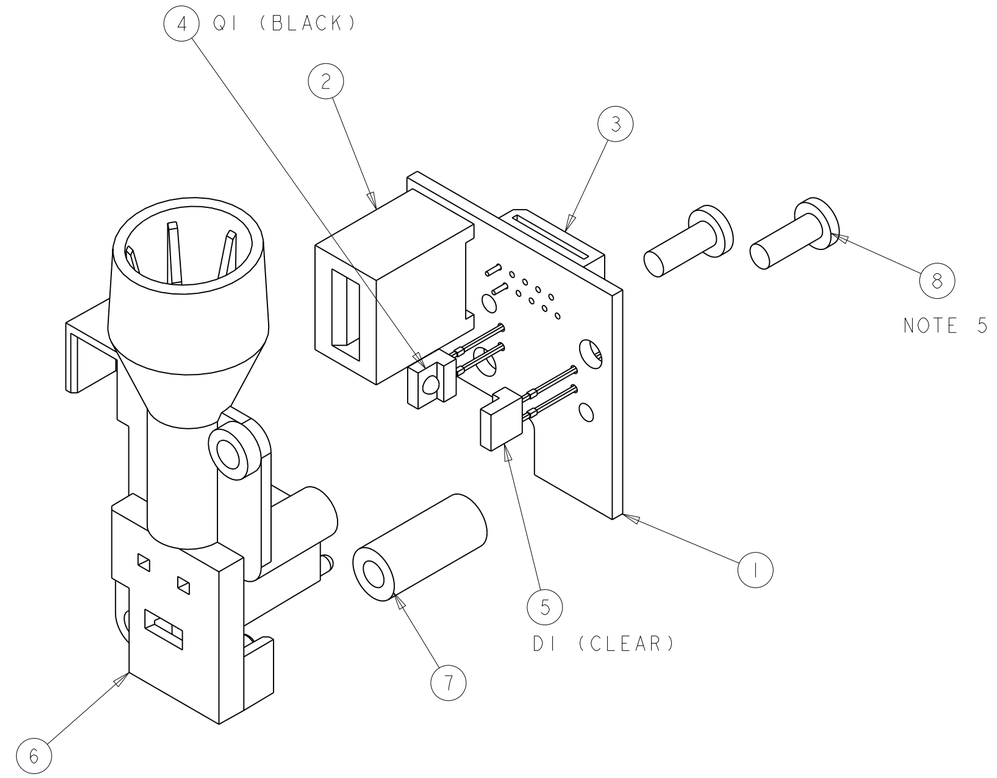
REV	DESCRIPTION	ECN/ECO	INIT	DATE	CKD
A	RELEASE TO PROD. ENG.	AMT41550-3	JRS	9/13/00	T.W.
B	REVISED .060 MAX. DIM.	AMT41550-14	JRS	11/5/00	T.W.
C	REMOVE B.O.M. (TABLE)	AMT41550-15	JRS	11/15/00	T.W.

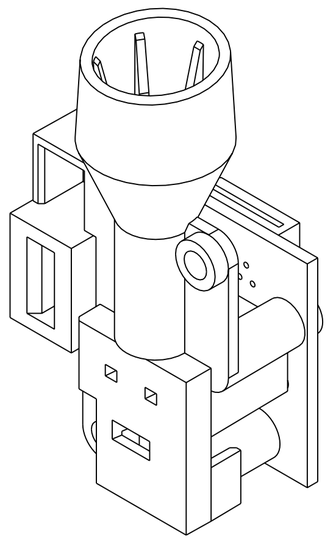






SECTION IR-IR





NOTES:
1. ASSEMBLY TO CONFORM TO THE LATEST REVISION OF IPC-A-610 CLASS 2 STANDARDS FOR ELECTRONIC ASSEMBLIES, UNLESS OTHERWISE SPECIFIED. REWORK IS ACCEPTABLE IF IT CONFORMS TO THE LATEST REVISION OF IPC-R-700C.
2. COMPLETE PCB ASSEMBLY TO BE LABELED WITH:
   -WELCH ALLYN ASSEMBLY PART NUMBER
   -REVISION LEVEL
   -DATE CODE (WEEK YEAR eg 2200)
4. PACKAGING TO BE APPROVED BY WELCH ALLYN.
5. TORQUE SCREWS TO 9-10 inlbs.
6. SENSORS TO BE BOTTOMED IN PROBE HOUSING.
7. TRIM LEADS OF ITEM 4 (QI) AND ITEM 5 (DI) TO DIMENSION SHOWN.

THIS DWG -501	-
PART NO.	DESCRIPTION

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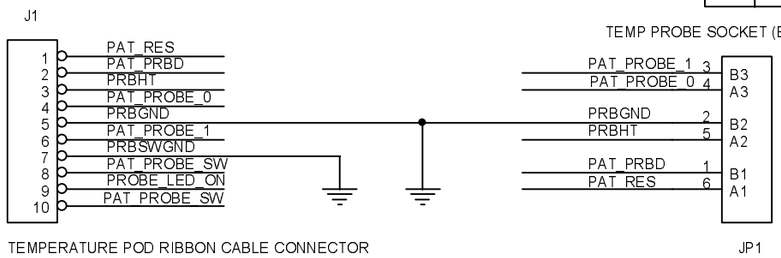
DRAWN TJW	DATE 08-Aug-00	Welch Allyn®
APPROVED T. WAWRO	DATE 9/26/00	MATERIAL: -
REL TO PROD J. HOWARD	DATE 9/26/00	FINISH: -
T. EDMONDSON	9/26/00	TITLE ASSY. TEMPERATURE POD PCB
CAD SOFTWARE:	ProE	
TRANSLATED FROM:		

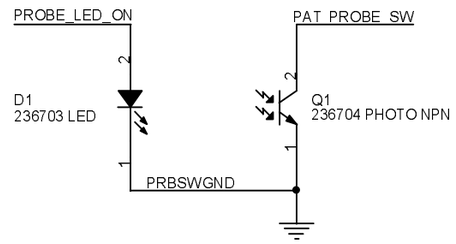
UNLESS OTHERWISE SPECIFIED
TOLERANCES DIMENSIONS ARE IN INCHES
.XX = ±.02
.XXX = ±.005
ANGLES ±2°

C	DRAWING NO. 421105	REV C
SCALE 2.000	SHEET 1 of 1	

REV	DESCRIPTION	ECN	INIT	DATE	APPROVAL
A	RELEASE TO PRODUCTION	AMT41550-3	WNC	09-27-00	KNUT SPANG

CONNECTION TO J1 OF SPOT MAIN PCB





REV	REVISION DESCRIPTION	ECN	INIT	DATE	APPRV

DRAWN WILL CUIPYLO — DATE 09-08-00

APPROVED KNUT SPANG — DATE 09-27-00

REL TO PRODUCTION JERRY HOWARD — DATE 09-27-00

Welch Allyn

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TITLE: SPOT CHECK TEMPERATURE POD PCB

Copyright Tuesday, September 26, 2000

Size B | DWG NO 421107 | Sheet 1 of 1 | Rev A

Section 7 Repair Test Specifications

Repair Test Specifications

Spot Vital Signs

Original Date: 16 August 2000
Current Revision Date: 4 January 2001
Current Revision Number: 1.4

File: 126P182.DOC

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General Notes

Note 1: The word “Unit” throughout this document refers to the Spot Vital Signs with out pneumatics (tubing and cuff), temperature probe, SpO2 probe, and main battery attached, unless other wise noted.

Note 2: Standard test voltage unless otherwise stated is 6.5 (+0/- 0.25) Vdc.

Note 3: All test are performed utilizing the Repair Software for the Spot Vital Signs or following the procedures called out in the Spot Service Manual.

Note 5: Unless otherwise stated, all calibrated volumes will be +/- 10cc of the stated volume.

Note 6: Unit software for the Spot Vital Signs will be equal to or greater than “1.00” for “Spot” software (SW 1) and equal to or greater than “1.00” for ModB software (SW2). If the unit has Nellcor SpO2, the SpO2 software will be equal to or greater than “1.2.0.0.” If the unit has temperature, the temperature software will be equal to or greater than “2.1.”

Repair Test

General Unit Test

A-D Noise Test

The A-D Noise Test is defined as the amount of noise on the Unit A-D pressure channel, over a 1 second sample time while 0.0 mmHg is applied to the Unit pressure port. The maximum limit is 0.050 mmHg.

Leak Test

Leak Test is defined as the amount of pressure drop that is recorded over a 15 second interval with a 100cc volume attached to the Unit pressure port and that volume having a stabilized pressure of 250 mmHg. The limit is 5 mmHg max

Inflation Test

Inflation Test is defined as the amount of time the Unit pump can inflate a 250cc volume from 5 mmHg to 210 mmHg. The limit is 7 seconds, max.

Dump Test

Dump Test is defined as the amount of time it takes the Unit to deflate a 500cc volume from 260 mmHg to less than 15 mmHg. The limit is 10 seconds.

Pneumatic Calibration

Note: The Unit can not be calibrated if the internal temperature is beyond 32'C.

The unit will be calibrated with 0 and 250 mmHg applied to the pressure port with the following algorithm:

-Adjust the pressure calibration 'offset' value with the following formula.((Last autozero pressure value + current unit pressure) * 16384 /(pressure offset correction value + pressure gain correction value)). The pressure offset value must be -15384 to 15384.

-The Unit must be able to successfully perform an autozero.

-Adjust the pressure gain value until the unit pressure deviation from the applied pressure is less than 0.1 mmHg. Continue to utilize the following formula until the pressure is less than 0.1 mmHg. (applied pressure / unit pressure) * pressure gain value. The pressure gain value must be 1000 to 31767

When the pressure transducer calibration is performed(only when successful), a calibration signature will be stored in the Unit memory. The calibration signature can be any of up to four printable characters.

When the pressure transducer calibration is performed(only when successful), the date and time of that calibration will be stored in the Unit memory.

Pneumatic Accuracy Test

Note: This test will be conducted in the configuration mode of the Spot Vital Signs.

Perform Autozero before the start of this test. The Pneumatic Accuracy test is defined as the comparison of the Unit pressure measurement and applied pressure at 0, 50, 175, and 275. The maximum limit for the 0 reading will be +/- 1.0 mmHg, all others +/- 3.0 mmHg.

Valve Control Test

With a 100 cc volume connected to the Unit pressure port and pressurized to 160 mmHg, give Unit commands to open the valve for 10 mSec., 15 mSec., and 25 mSec. And record each pressure drop. The pressure drops will be 4 to 12 mmHg, 4 to 15 mmHg, and 4 to 25 mmHg respectively.

Battery Calibration Requirements
The Unit battery voltage measurement circuit will be calibrated at 5.5 +0.2/- 0 VDC.

The battery calibration factor must be 14,384 to 18,384.

When the Unit battery measurement circuit is successfully calibrated, a calibration signature will be stored in the Unit memory. The calibration signature can be any of up to four printable characters.

Blank Mode Current Test
The Blank Mode Current Test is defined as the amount of current that is drawn through the battery terminals, all LCD segments are turned off, the back light is off, the SpO2 mode is turned off. The limit is 200 mA. max.

Back Light(Idle) Current Test
The Back Light Current Test is defined as the amount of current that is drawn through the battery, all LCD segments are turned on, the back light turned on, the SpO2 mode is turned off. The limit is 400 mA. Max.

Valve/Pump Mode Current Test
The Valve/Pump Mode Current Test is defined as the amount of current that is drawn through the battery terminals, the Unit is in the Blank Mode, Unit valve and pump actuated to on. The limit is 700 mA, max.

IR Interface Tests
The Unit will be able to communicate through the IR Port. Opening the IR Port and successfully issuing a command with no errors returned will be sufficient to test the IR Interface.

Interface Test
When given the proper commands, the Spot Display will turn on all segments, turn off all segments, turn on the back light or turn off the back light. When give the proper command, the spot unit buzzer will come on to ensure operation. The pass/fail criteria is subjective to the user.

Temperature Option Requirements

Accuracy Testing
The accuracy of the temperature module must be within +/- 0.2F for readings with a nominal temperature of 97.3F (36.3C) using a Cal Key (5200-25).The unit must be able to read a temperature of 96.4F (35.8C) and a temperature of 106F (41.1C) within +/- 0.3F (+/-0.2C) using a Welch Allyn 9600 Calibrator.
Note: if using a water bath to take temperatures, the temperature of the bath should be between 84F and 106F (28.8 and 41.1C)and the reading must agree within +/-1.0F (0.8C) measuring against a temperature standard that is accurate to within +/-1.0 F (0.8C).

Temperature Probe Test
The unit will display “188.8” and then “ORL” once the oral probe is removed from the probe housing.

SpO2 Option Requirements

Note: These tests are only performed if configured forSpO2.

SpO2 Functional Test
The SpO2 Functional Test is defined as the ability of the Unit to correctly report an applied SpO2 signals from a Nellcor SRC2 Simulator. The applied signals are 81% O2, 112 BPM at a saturation level of 100. The limits are +/-3 counts for the O2 readings and +/- 3 counts for BPM readings.

SpO2 Mode Current Test

The SpO2 Mode Current Test is defined as the amount of current, less the Blank Mode Current, that is drawn through the battery terminals, placing the Unit in the Blank Mode, actuating the SpO2 mode and applying any SpO2 signal to the Unit. The maximum limit is 120 mA, max.

Fail Safe Testing

Over Pressure Test

The unit will be able to detect over pressure on the unit's pneumatic system between 296.0 mmHg and 329 mmHg.

Over 15 mmHg

The unit will be able to detect if the static pressure has been over 15 mmHg for 180 second.